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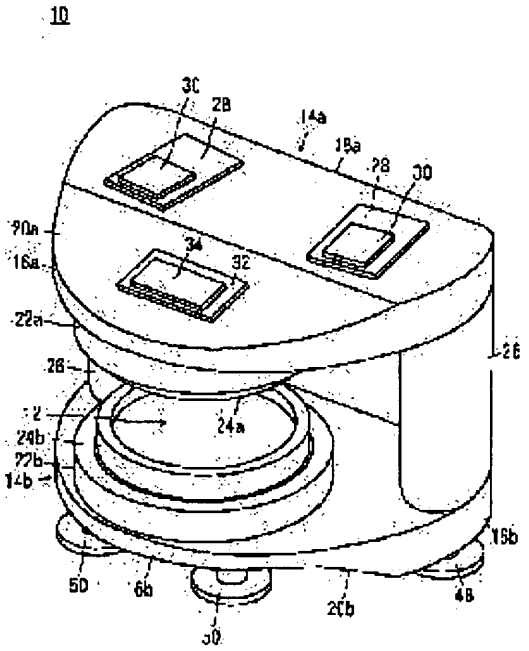
(54) MAGNETIC FIELD GENERATOR

(57)Abstract:

PROBLEM TO BE SOLVED: To completely perform assembly work by more effectively suppressing leaked magnetic flux and preventing the damage of a magnet for shield.

SOLUTION: A magnetic field generator 10 is an opened type device and is provided with a pair of plate-like yokes 14a and 14b arranged while facing by forming a void 12. At the back of the upper surface of the plate-like yoke 14a, a magnet 30 for shield is arranged through a spacer 28. In the case of assembly, the magnet 30 for shield is attached on the upper surface of the spacer 28 and afterwards, in such a state, the spacer 28 is attached on the plate-like yoke 14a. Similarly, in front of the opened side of the upper surface of the plate-like yoke 14a, a magnet 34 for shield is arranged through a spacer 32. The magnets 30 and 34 for shield are overlaid by cover members 38 and 44. Similarly, the spacers 28 and 32, the magnets 30 and 34 for shield and the cover members 38 and 44 are provided on the lower surface of the plate-like yoke 14b as well. Besides, non-magnetic leg parts 48 and 50 are provided on the lower surface of the plate-like yoke 14b.



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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view showing 1 operation gestalt of this invention.
[Drawing 2] It is the top view showing 1 operation gestalt of this invention.
[Drawing 3] It is the front view showing 1 operation gestalt of this invention.
[Drawing 4] It is the illustration Fig. showing the condition of having attached the covering member.
[Drawing 5] It is the bottom view showing 1 operation gestalt of this invention.
[Drawing 6] It is the illustration Fig. showing an example of the assembly approach of the magnet for shielding, and a SU **-sir.
[Drawing 7] It is the table showing an experimental result.
[Drawing 8] It is an illustration Fig. for explaining an experimental result.
[Description of Notations]
10 Field Generator
12 Opening
12a Homogeneity field space
14a, 14b Tabular yoke
16a, 16b Anterior part of a tabular yoke
18a, 18b Posterior part of a tabular yoke
20a, 20b Slant face of a tabular yoke
22a, 22b Permanent magnet
24a, 24b Pole piece
26 Support Yoke
28 32 Spacer
30 34 Magnet for shielding
38 44 Covering member
48 50 Leg
P The core of homogeneity field space
alpha Open include angle
T1, T2 Distance between the outside front face of a covering member, and the front face of the magnet for shielding

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] More specifically, this invention relates to the field generator for MRI about a field generator.
[0002]
[Description of the Prior Art] A technical example which reduces leakage flux in the field generator for MRI is indicated by JP,5-41530,Y. Here, in the principal plane of a tabular yoke, generating of leakage flux is controlled by arranging the magnet for shielding which becomes the periphery equivalent location of the permanent magnet construct currently attached in the rear-face side from eight ferrite magnets annularly.
[0003]
[Problem(s) to be Solved by the Invention] However, in the field generator for MRI which generates the high field more than of 0.3T with this related technique, it is difficult to control leakage flux effectively. Also when it constitutes the field generator for MRI made to generate such a high field in an open sand mold, it is difficult to control leakage flux effectively. Moreover, with an above-mentioned related technique, since the magnet for shielding is exposed to the outside of a field generator, the magnetic substance, such as a tool and a chain, may be drawn during assembly and transportation. Since the magnet for shielding itself is a sintered compact when such a thing occurs, the magnet for shielding may be damaged at the time of suction. Moreover, when the magnetic substance which was attracted and stuck to the magnet for shielding is large, the problem that it cannot remove is also produced by human power.
[0004] Furthermore, the latest field generator for MRI has the leg. Although it is attached after this leg's consisting of the magnetic substance and pasting up the magnet for shielding on the principal plane of a tabular yoke, the leg may be attracted by the magnet for shielding and an operator may be exposed to risk. In order that above-mentioned evil may make magnet weight light, when a rare earth sintered magnet with powerful magnetism is used for the magnet for shielding, it is remarkable.
[0005] Moreover, seen from the core of field generating space, the field generator which has the open section of 150 degrees or more succeeding the equipment front is proposed, and it is spreading in recent years. With such equipment, the leakage of magnetic flux becomes large in the open section. In the case where the equipment front is constituted in the shape of a slant face in order to attain lightweight-ization of equipment, and the field generator made to generate the strong field beyond 0.3T, this problem becomes more remarkable. Although leakage flux will decrease to some extent if the tabular yoke ahead of equipment is thickened, in the field generator which has the open section of 150 degrees or more continuously, the supporting structure is unstable and cannot thicken a tabular yoke.
[0006] So, the main purpose of this invention will be offering the field generator which can control more effectively the unnecessary field generated on the outside of a field generator, if a leakage flux paraphrase is carried out. Other purposes of this invention are offering the field generator which can prevent breakage of the magnet for shielding. The purpose of others of this invention is offering the field generator which can do an assembly activity on insurance.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, a field generator according to claim 1 Two or less support yokes which combine magnetically the tabular yoke of the pair by which forms an opening and opposite arrangement is carried out, and the tabular yoke of a pair, It has the 1st magnet for shielding and the 2nd magnet for shielding which are formed the disconnection side front and behind the another side principal plane of each permanent magnet of the tabular yoke of a pair which counters, and which is arranged on the other hand at a principal

plane, and one [at least] tabular yoke, respectively. A field generator according to claim 2 is equipped with the covering member prepared in each permanent magnet of the tabular yoke of the pair by which forms an opening and opposite arrangement is carried out, and the tabular yoke of a pair which counters, and which is arranged on the other hand at a principal plane, the magnet for shielding formed in the another side principal plane of one [at least] tabular yoke, and the magnet for shielding.

[0008] A field generator according to claim 3 is characterized by a covering member being a nonmagnetic member in a field generator according to claim 2. A field generator according to claim 4 is characterized by setting the distance between the outside front face of a covering member, and the front face of the magnet for shielding as 2mm or more in a field generator according to claim 3.

[0009] A field generator according to claim 5 is equipped with the nonmagnetic leg formed in the another side principal plane of the tabular yoke in which each permanent magnet of the tabular yoke of the pair by which forms an opening and opposite arrangement is carried out, and the tabular yoke of a pair which counters, and which is arranged on the other hand at a principal plane, the magnet for shielding formed in the another side principal plane of one [at least] tabular yoke, and the magnet for shielding are formed. The tabular yoke of the pair by which a field generator according to claim 6 forms an opening, and opposite arrangement is carried out, Each permanent magnet of the tabular yoke of a pair which counters and which is arranged on the other hand at a principal plane, The support yoke prepared so that the open section which combines the tabular yoke of a pair magnetically and has the open include angle of 150 degrees or more continuously seen from the core of the homogeneity field space between permanent magnets may be formed, And it has the magnet for shielding formed in the another side principal plane corresponding to the open section of one [at least] tabular yoke.

[0010] The another side principal plane of a tabular yoke has a slant face so that, as for a field generator according to claim 7, a tabular yoke may become thin in a field generator according to claim 6, and it is characterized by forming the magnet for shielding in a slant face. A field generator according to claim 8 is characterized by generating the field beyond 0.3T in homogeneity field space in a field generator according to claim 6 or 7. A field generator according to claim 9 is characterized by the magnet for shielding being a rare earth sintered magnet in a field generator given in either of claims 1-8.

[0011] In a field generator according to claim 1, it can control that unnecessary magnetic flux leaks from the equipment front by forming the 1st magnet for shielding ahead [of the another side principal plane of a tabular yoke / disconnection side]. Furthermore, leakage flux generated in equipment back with the 2nd magnet for shielding can be made small. In a field generator according to claim 2, since the magnet for shielding is protected by the covering member, breakage of the magnet for shielding can be prevented.

[0012] In a field generator according to claim 3, leakage flux can be reduced certainly, without making the magnetic flux generated with the magnet for shielding short-circuit, since a covering member is a nonmagnetic member. In a field generator according to claim 4, since the distance between the outside front face of a covering member and the front face of the magnet for shielding is set as 2mm or more, the suction force of the magnet for shielding to a magnetic member can be weakened. Therefore, when a magnetic member (for example, tool) adsorbs, it becomes easy to remove the adsorbed magnetic member from a covering member.

[0013] In a field generator according to claim 5, since the leg consists of non-magnetic material, it can prevent that the leg is attracted by the magnet for shielding at the time of assembly operation, and an operator is not exposed to risk. Forming the magnet for shielding in the location corresponding to the open section among tabular yokes like a field generator according to claim 6 in the field generator of an open sand mold, since the leakage flux by the side of the open section is large has large effectiveness.

[0014] Since leakage flux becomes large when a part of tabular yoke is deleted for lightweight-izing of equipment, the thing [forming the magnet for shielding in the thin part of a tabular yoke] according to claim 7 is [like] effective. This invention is suitable for the field generator according to claim 8 which generates the field beyond 0.3T to homogeneity field space like. Thus, since leakage flux increases more in the field generator made to generate a strong field, it is effective to form the magnet for shielding. By [according to claim 9] combining like, using a rare earth sintered magnet with large magnetism as a magnet for shielding, and using a spacer, leakage flux can be controlled more effectively, without producing magnetic saturation with a small amount of magnet.

[0015]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a

drawing. With reference to drawing 1 thru/or drawing 4 , the field generator 10 for MRI of 1 operation gestalt of this invention is open sand mold equipment, and contains the tabular yokes 14a and 14b of the pair by which forms an opening 12 and opposite arrangement is carried out. Tabular yoke 14a contains anterior part 16a and posterior part 18a by the side of disconnection. The top face of anterior part 16a is set to slant-face 20a, tabular yoke 14a is thinly formed toward the front of the open section, and lightweight-ization of a yoke is attained. Similarly, tabular yoke 14b contains anterior part 16b and posterior part 18b by the side of disconnection. Anterior part 16b is formed more thinly than posterior part 18b for lightweight-izing of a yoke, and the inferior surface of tongue of anterior part 16b stands in a row on the inferior surface of tongue of posterior part 18b through slant-face 20b.

[0016] Permanent magnets 22a and 22b are arranged at each opposed face side of the tabular yokes 14a and 14b, and pole pieces 24a and 24b fix to each opposed face side of permanent magnets 22a and 22b. And the tabular yokes 14a and 14b of a pair are magnetically combined by the support yoke 26 of the shape of two columns arranged between each both ends of posterior parts 18a and 18b. The tabular yokes 14a and 14b and the support yoke 26 consist of soft iron. Thus, in the field generator 10 of an open sand mold, the support yoke 26 is arranged in equipment back. As shown in drawing 3 , of such a configuration, homogeneity field space 12a is formed between permanent magnet 22a and 22b, and magnetic flux as shown by the arrow head Y occurs by it. At this time, as shown in drawing 2 , the support yoke 26 is arranged seen from the core P of homogeneity field space 12a formed between permanent magnet 22a and 22b so that the open include angle alpha of the open section may turn into 150 degrees or more continuously. The open section means the space where the support yoke 26 does not exist.

[0017] Moreover, the SU **-sir 28 of the shape of two rectangle corner guard is arranged symmetrically on the posterior part 18a top face of tabular yoke 14a, and the abbreviation square corner guard-like magnet 30 for shielding is arranged on the SU **-sir 28. If it puts in another way, two magnets 30 for shielding will be formed behind the top face of tabular yoke 14a. drawing 2 shows -- as -- a tabular yoke 14a top -- setting -- each magnet 30 for shielding -- the part -- it is arranged so that 30a may not lap with a flash and the support yoke 26 from the periphery edge A1 (it forms in a rear-face side) of permanent magnet 22a but may form a gap G. Since the support yoke 26 serves as a magnetic path as an arrow head B shows to drawing 3 , and magnetic flux concentrates on a part for the bond part of tabular yoke 14a and the support yoke 26, it is easy to carry out magnetic saturation of the part of tabular yoke 14a located in a gap G. Thus, by avoiding the field which is easy to carry out magnetic saturation, and arranging the magnet 30 for shielding, leakage flux can be controlled without promoting magnetic saturation, and the magnetic field strength in opening 12 core can be secured.

[0018] Furthermore, the rectangle corner guard-like SU **-sir 32 is arranged at slant-face 20a on the top face of anterior part 16a of tabular yoke 14a, and the rectangle corner guard-like magnet 34 for shielding is arranged on the SU **-sir 32. If it puts in another way, the magnet 34 for shielding will be formed ahead [of the top face of tabular yoke 14a / disconnection side]. Generally, in the field generator 10 of an open sand mold, the leakage flux by the side of the open section is large. Then, leakage flux can be further controlled by arranging the magnet 34 for shielding to anterior part 16a of equipment in this way.

[0019] the thickness of the SU **-sirs 28 and 32 -- for example, 30mm -- it is -- electromagnetism -- it consists of soft iron. The magnets 30 and 34 for shielding assemble the magnet simple substance of the shape of a rectangular parallelepiped of 35x50x50mm of abbreviation, and they are formed so that it may have magnetization of the direction of leakage flux, and hard flow. As a magnet used for the magnets 30 and 34 for shielding, a neodymium sintered magnet (R-Fe-B system sintered magnet), a samarium cobalt magnet, an alnico magnet, and a ferrite magnet can be used. Among these, weight may increase and demagnetization may generate a ferrite magnet at about -20-degree C low temperature during transportation. Since it is also required to be able to obtain a high shielding effect, and to make a magnet thin, and to miniaturize equipment if the magnet which has a high energy product is used, it is desirable to use a rare earth sintered magnet. Although there should just usually be 1000 or more kA/m as coercive force, when becoming an elevated temperature at the time of transportation, the ingredient of still higher coercive force is desirable. NEOMAX-39SH same as NEOMAX-47 by Sumitomo Special Metals Co., Ltd. and magnets 30 and 34 for shielding as permanent magnets 22a and 22b for example, by Sumitomo Special Metals Co., Ltd. etc. is used. It is indicated by U.S. Pat. No. 4,770,723 and No. 4,792,368 about the R-Fe-B system sintered magnet.

[0020] In addition, as shown in drawing 4 , a spacer 28 is fixed to tabular yoke 14a by the spacer mounting screw 36, and a spacer 28 and the magnet 30 for shielding are covered with the covering member 38. The covering member 38 consists of a nonmagnetic member which consists of SUS304 etc., and is attached in the posterior part 18a top face of

tabular yoke 14a by the covering mounting screw 40. Moreover, a spacer 32 is fixed by the spacer mounting screw 42, and a spacer 32 and the magnet 34 for shielding are covered with the covering member 44. The covering member 44 also consists of a nonmagnetic member which consists of SUS304 (stainless steel) etc., and is attached by the covering mounting screw 46 on slant-face 20a of anterior part 16of tabular yoke 14a a. The magnets 30 and 34 for shielding consisted of two or more magnet simple substances, and each magnet simple substance made the like pole adjoin on a spacer 28 and 32, and they have pasted it up. Therefore, although there is a possibility that a magnet simple substance may jump out by repulsive force when adhesion separates, the covering members 38 and 44 have prevented this. At this time, the distance T1 between the outside front face of the covering member 38 and the front face of the magnet 30 for shielding and the distance T2 between the outside front face of the covering member 44 and the front face of the magnet 34 for shielding are set as 2mm or more, respectively.

[0021] As shown in drawing 5 , two SU **-sirs 28 are similarly arranged symmetrically about the tabular yoke 14b side on the inferior surface of tongue of posterior part 18b of tabular yoke 14b, and the magnet 30 for shielding is arranged on the SU **-sir 28. If it puts in another way, two magnets 30 for shielding will be formed behind the inferior surface of tongue of tabular yoke 14b. drawing 5 shows -- as -- a tabular yoke 14b top -- setting -- each magnet 30 for shielding -- the part -- it is arranged so that 30a may not lap with a flash and the support yoke 26 from the periphery edge A2 of permanent magnet 22b but may form a gap G. Moreover, the SU **-sir 32 is arranged in the flat side of the inside under [of tabular yoke 14b] anterior part 16b, and the magnet 34 for shielding is arranged on the SU **-sir 32. If it puts in another way, the magnet 34 for shielding will be formed ahead [of the inferior surface of tongue of tabular yoke 14b / disconnection side]. In addition, like the case of tabular yoke 14a shown in drawing 4 R> 4, the SU **-sir 28 and the magnet 30 for shielding, the SU **-sir 32, and the magnet 34 for shielding are covered with a covering member, and each part material is fixed to the tabular yoke 14b side.

[0022] As mentioned above, since the magnets 30 and 34 for shielding are protected by the covering members 38 and 44, respectively, breakage of the magnets 30 and 34 for shielding can be prevented. Moreover, leakage flux can be reduced certainly, without also making the magnetic flux generated with the magnets 30 and 34 for shielding short-circuit covering, since the covering members 38 and 44 are nonmagnetic members. Furthermore, since distance T1 and T2 is set as 2mm or more, even if a magnetic member is attracted by the magnets 30 and 34 for shielding, the suction force can be weakened, and it becomes easy to remove the adsorbed magnetic member from the covering members 38 and 44.

[0023] The leg 48 is attached in the location corresponding to two support yokes 26, respectively, and the two legs 50 are attached in the inferior surface of tongue of tabular yoke 14b at the flat part of the inside under [of tabular yoke 14b] anterior part 16b. The legs 48 and 50 consist of non-magnetic material. It can prevent that the legs 48 and 50 are attracted by the magnet 30 for shielding, and 34 at the time of assembly operation, and an operator is not exposed to risk by this. In the field generator 10, the SU **-sir 28, the magnet 30 for shielding, and the covering member 38 are attached in tabular yoke 14a as follows.

[0024] With reference to drawing 6 , first, the both ends of tabular yoke 14a are supported by susceptor 52, and the four guide bar 54 is set up by the predetermined part on tabular yoke 14a. And the magnet 30 for shielding is fixed to the position on the SU **-sir 28 with adhesives etc., and the SU **-sir 28 of this condition is lifted with a crane etc., it is carried on tabular yoke 14a, the guide bar 54 is inserted in each hole 56 of the SU **-sir 28, and the SU **-sir 28 descends. The SU **-sir 28 and the magnet 30 for shielding are arranged by this at the position on tabular yoke 14a. Then, the guide bar 54 is removed, instead the spacer mounting screw 36 is screwed in, and the SU **-sir 28 is fixed on tabular yoke 14a. And on the fixed SU **-sir 28 and the magnet 30 for shielding, the covering member 38 is put and the covering member 38 is attached by the covering mounting screw 40 at tabular yoke 14a. The same is said of the SU **-sir 34, the magnet 36 for shielding, and the covering member 44. Moreover, the SU **-sirs 30 and 34, the magnets 32 and 36 for shielding, and the covering members 38 and 44 are similarly attached about the inferior surface of tongue of tabular yoke 14b.

[0025] The example of 1 experiment of such a field generator 10 is explained. About each **** of ** to ** shown in drawing 7 , the distance (field 1mT Rhine) to the location where a field serves as 1mT from the magnetic field strength in the core P of homogeneity field space 12a and the core P of homogeneity field space 12a in the central upper part of tabular yoke 14a was measured. If the distance to field 1mT Rhine is small, leakage flux means few things. Here, according to each **** of ** to **, it attached and experimented in the SU **-sir or the magnet for shielding on three places each of the tabular yokes 14a and 14b shown in drawing 1 - drawing 3 , and drawing 5 .

[0026] ** When an attaching member, i.e., a SU **-sir, and the magnet for shielding were not attached, the result as are shown in drawing 8 (a), and magnetic flux flows and shows the inside of tabular yoke 14a to drawing 7 was obtained.
[0027] ** although magnetic field strength improves since the thickness of the tabular yokes 14a and 14b increases substantially as shown in drawing 8 (b) when only the SU **-sirs 28 and 32 which become the tabular yokes 14a and 14b from iron are attached -- leakage flux -- only -- **** -- it did not decrease.
[0028] ** When the magnets 30 and 34 for shielding were directly stuck on the tabular yokes 14a and 14b, as leakage flux was shown in drawing 8 (c) of what decreasing, when the tabular yokes 14a and 14b carried out magnetic saturation partially by the magnetic flux which the magnet 30 for shielding and 34 selves generate, permeability became low partially, and the magnetic field strength in the core P of homogeneity field space 12a fell.
[0029] ** In equipping with the magnets 30 and 34 for shielding the SU **-sirs 28 and 32 which consist of a nonmagnetic member (SUS304) and attaching in the tabular yokes 14a and 14b, it keeps away the magnets 30 and 34 for shielding from the tabular yokes 14a and 14b. Therefore, from the case of **, since the magnetic flux which the magnet 30 for shielding and 34 selves generate did not affect the magnetic reluctance of the tabular yokes 14a and 14b as shown in drawing 8 (d) although leakage flux increased a little, the magnetic saturation in the tabular yokes 14a and 14b was controlled, and the magnetic field strength of the part in the core P of homogeneity field space 12a improved. However, a part of magnetic flux generated with the magnets 30 and 34 for shielding will flow to the tabular yokes 14a and 14b.
[0030] ** In equipping with the magnets 30 and 34 for shielding the SU **-sirs 28 and 32 which consist of iron and attaching in the tabular yokes 14a and 14b The magnetic flux which the magnets 30 and 34 for shielding generate as shown in drawing 8 (e) does not mainly affect [be / it / under / spacer 28 and 32 / passing] the magnetic reluctance of the tabular yokes 14a and 14b. Since the SU **-sirs 28 and 32 furthermore consisted of iron and the thickness of the tabular yokes 14a and 14b increased substantially, magnetic saturation was controlled, and magnetic field strength could be improved, and leakage flux was able to be lessened.
[0031] Therefore, since the magnets 30 and 34 for shielding can be kept away from the tabular yokes 14a and 14b by forming the SU **-sirs 28 and 32, respectively according to the field generator 10, the magnetic saturation of the tabular yokes 14a and 14b can be eased, and the magnetic field strength of an opening 12 can be improved. Furthermore, leakage flux can be lessened when the SU **-sirs 28 and 32 consist of magnetic members, such as iron. Since there is an inclination which magnetic flux concentrates locally in a part for the bond part of a yoke and it especially becomes easy to generate magnetic saturation in that part in the field generator of an open sand mold like the field generator 10, this invention is effective. Moreover, when magnetism unites using a large rare earth sintered magnet as magnets 30 and 34 for shielding and uses spacers 28 and 32, leakage flux can be controlled more effectively, without producing magnetic saturation with a small amount of magnet.
[0032] If it is going to attach the magnets 30 and 34 for shielding directly on tabular yoke 14a and 14b, respectively, a suction force strong between the tabular yokes 14a and 14b and the magnets 30 and 34 for shielding will occur, and it will become difficult to arrange the magnets 30 and 34 for shielding with a sufficient precision safely at a position. However, in the field generator 10, since the magnets 30 and 34 for shielding are beforehand attached in the SU **-sirs 28 and 32 and the SU **-sirs 28 and 32 are attached in the principal plane of the tabular yokes 14a and 14b in the condition, the magnets 30 and 34 for shielding can be easily arranged to the position on the SU **-sir 28 and 32, and the field generator 10 can be assembled safely. It is more effective when using a rare earth sintered magnet as magnets 30 and 34 for shielding.
[0033] Generally, if thickness of a tabular yoke is enlarged, leakage flux will decrease, but if it is going to generate the field of 0.35T, for example, the thickness of a tabular yoke will be set also to 30cm. Conveyance also becomes serious while an installation is restrained, since a field generator becomes 20t of abbreviation and the reinforcement of a floor is required at this time. Therefore, thickness of a tabular yoke cannot be made to increase more than by this. Therefore, the thickness of a tabular yoke is thinly set as extent with which magnetic flux is not saturated. For example, each anterior part 16a and 16b of the tabular yokes 14a and 14b is thinly formed like the field generator 10 for lightweight-izing of equipment. In this case, in the field which magnetic flux concentrates, a yoke will surely carry out magnetic saturation and magnetic flux will leak. So, leakage flux can be stopped in the field generator 10, attaining lightweight-ization of the field generator 10 without enlarging thickness of tabular yoke 14a and the 14b itself by arranging the magnets 30 and 34 for shielding through the SU **-SA members 28 and 32, respectively in required parts, such as a thin part of the tabular yokes 14a and 14b. Especially this invention is suitable for the field generator which generates

the strong field beyond 0.3T in homogeneity field space 12a.
[0034] Furthermore, since MRI equipment is installed in a hospital, if there is much leakage flux, the electronic equipment in a hospital may incorrect-operate. Moreover, if the person equipped with a pacemaker comes into a strong field field, a pacemaker may cause incorrect actuation. Therefore, in order to restrict the field which the field of 0.5 or more mTs generates to a narrow field, large-scale magnetic-shielding construction is needed, or a large installation tooth space is needed. However, since leakage flux can be lessened according to this invention, an above-mentioned trouble is improvable.
[0035] In addition, a spacer and the magnet for shielding may be formed only in either of the tabular yokes 14a and 14b. Moreover, this invention is applicable also to a field generator as applied also to the field generator which used one support yoke and four support yokes, for example, shown in JP,2000-139874,A.
[0036]
[Effect of the Invention] According to this invention, the magnetic saturation of a tabular yoke can be eased, and leakage flux can be lessened, without reducing the magnetic field strength of the opening between the tabular yokes of a pair. Moreover, by using a covering member, by being able to prevent breakage of the magnet for shielding and constituting the leg from non-magnetic material, it can prevent that the leg is attracted by the magnet for shielding at the time of assembly operation, and a field generator can be assembled safely.

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CLAIMS

[Claim(s)]
[Claim 1] A field generator equipped with the 1st magnet for shielding and the 2nd magnet for shielding which are formed the disconnection side front and behind the another side principal plane of each permanent magnet of two or less support yokes which combine magnetically the tabular yoke of the pair by which forms an opening and opposite arrangement is carried out, and the tabular yoke of said pair, and the tabular yoke of said pair which counters, and which is arranged on the other hand at a principal plane, and one [at least] of said tabular yoke, respectively.
[Claim 2] A field generator equipped with the covering member prepared in each permanent magnet of the tabular yoke of the pair by which forms an opening and opposite arrangement is carried out, and the tabular yoke of said pair which counters, and which is arranged on the other hand at a principal plane, the magnet for shielding formed in the another side principal plane of one [at least] of said tabular yoke, and said magnet for shielding.
[Claim 3] Said covering member is a field generator according to claim 2 which is a nonmagnetic member.
[Claim 4] The field generator according to claim 3 with which the distance between the outside front face of said covering member and the front face of said magnet for shielding is set as 2mm or more.
[Claim 5] A field generator equipped with the nonmagnetic leg formed in said another side principal plane of said tabular yoke in which each permanent magnet of the tabular yoke of the pair by which forms an opening and opposite arrangement is carried out, and the tabular yoke of said pair which counters, and which is arranged on the other hand at a principal plane, the magnet for shielding formed in the another side principal plane of one [at least] of said tabular yoke, and said magnet for shielding are formed.
[Claim 6] Each permanent magnet of the tabular yoke of the pair by which forms an opening and opposite arrangement is carried out, and the tabular yoke of said pair which counters and which is arranged on the other hand at a principal plane, The support yoke prepared so that the open section which combines the tabular yoke of said pair magnetically and has the open include angle of 150 degrees or more continuously seen from the core of the homogeneity field space between said permanent magnets may be formed, And a field generator equipped with the magnet for shielding formed in the another side principal plane corresponding to said open section of one [at least] of said tabular yoke.
[Claim 7] It is the field generator according to claim 6 with which the another side principal plane of said tabular yoke has a slant face, and said magnet for shielding is formed in said slant face so that said tabular yoke may become thin.
[Claim 8] The field generator according to claim 6 or 7 by which the field beyond 0.3T is generated in said homogeneity field space.
[Claim 9] Said magnet for shielding is a field generator given in either of claims 1-8 which is a rare earth sintered magnet.

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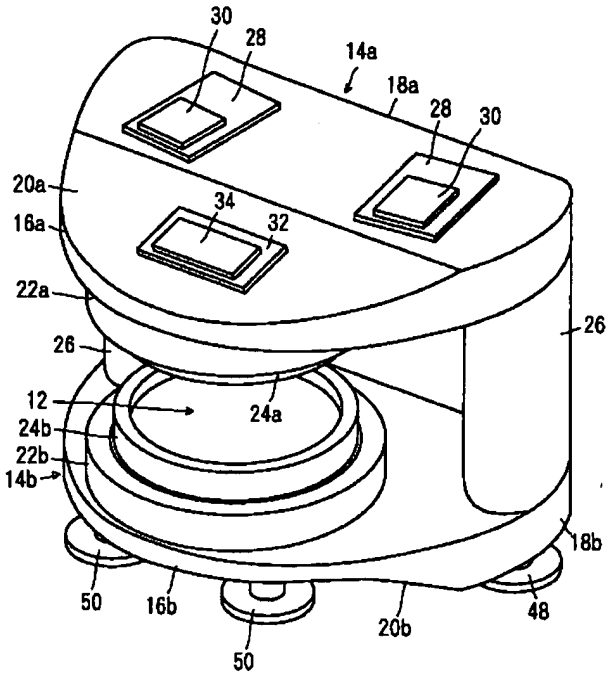
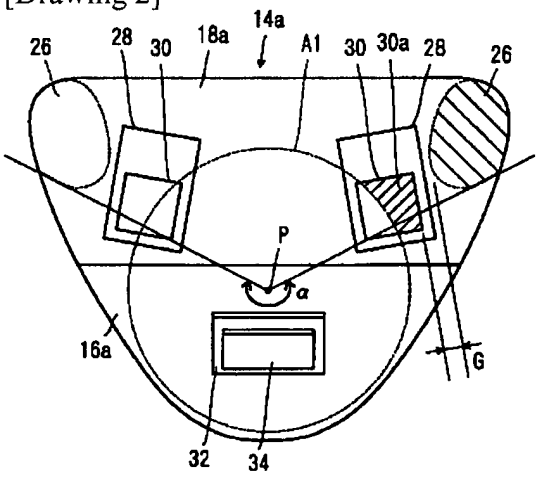
3.In the drawings, any words are not translated.

DRAWINGS

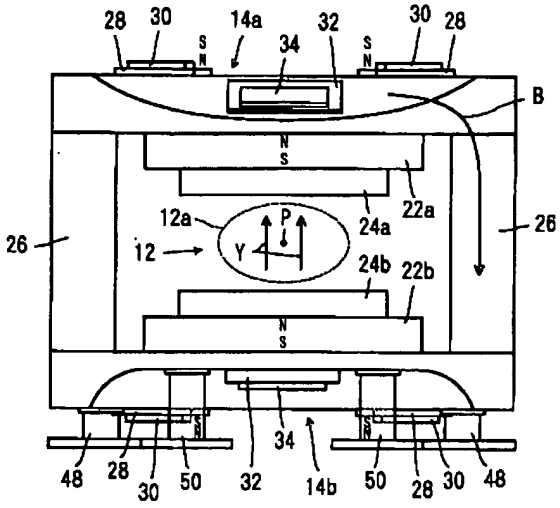
[Drawing 1]



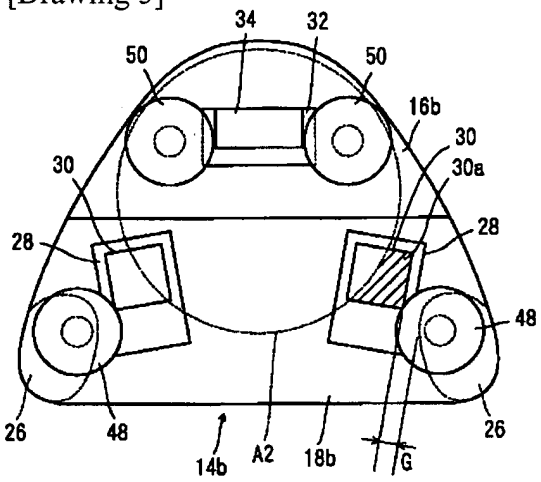
[Drawing 2]



[Drawing 3]



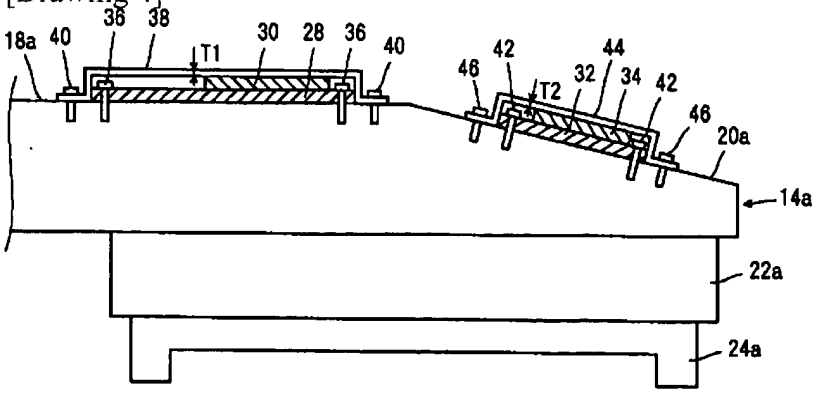
[Drawing 5]



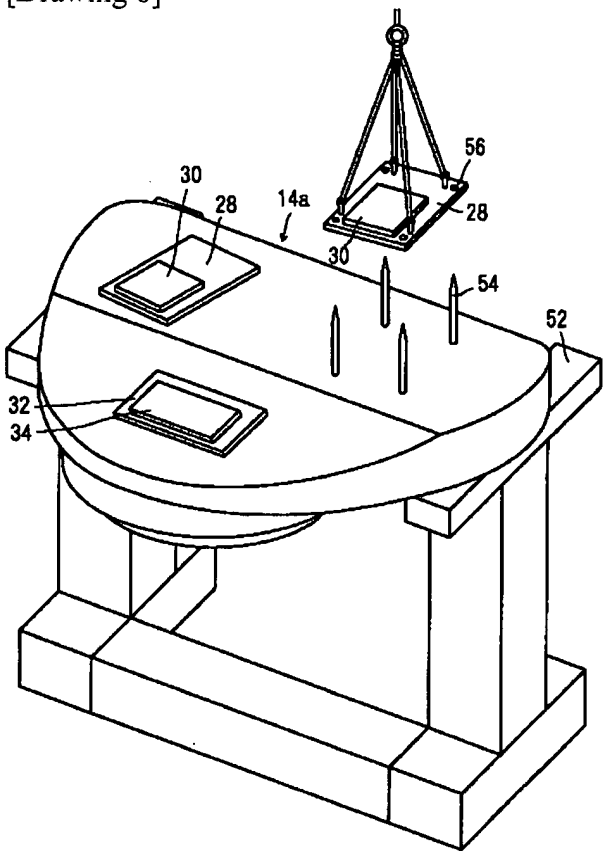
[Drawing 7]

	磁界強度	磁界1mTライン
①取り付け部材なし	0.3597 T	2.35 m
②鉄からなるスペーサーのみ取り付け	0.3602 T	2.25 m
③シールド用磁石取り付け（直接）	0.3584 T	2.03 m
④シールド用磁石＋非磁性のスペーサー取り付け	0.3588 T	2.07 m
⑤シールド用磁石＋鉄からなるスペーサー取り付け	0.3593 T	1.93 m

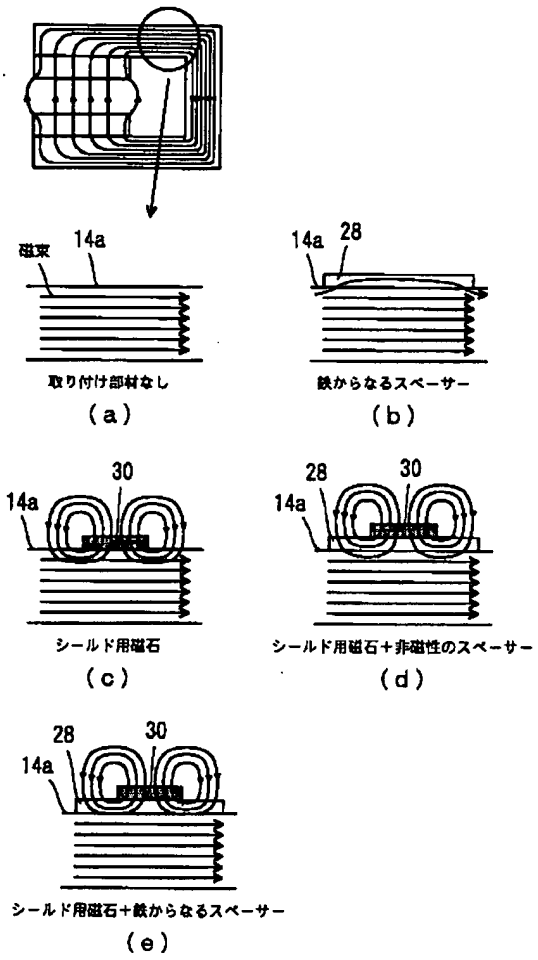
[Drawing 4]



[Drawing 6]



[Drawing 8]



[Translation done.]